Material Flow Analysis as a Circular economy tool to address the future stakes of fishery dependent costal socio-ecological systems

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Questions raised in the case study through the use of material flow analysis (MFA) tools

✓In the socio-ecological system of Cornouaille, a fishery-dependent region of France,

✓According to a definition of Circular Economy (CE) and its main principles (key words resource, flow, system, area-territory, value)

How does the circular economy, offer

✓to optimize the use of the fishery resources,

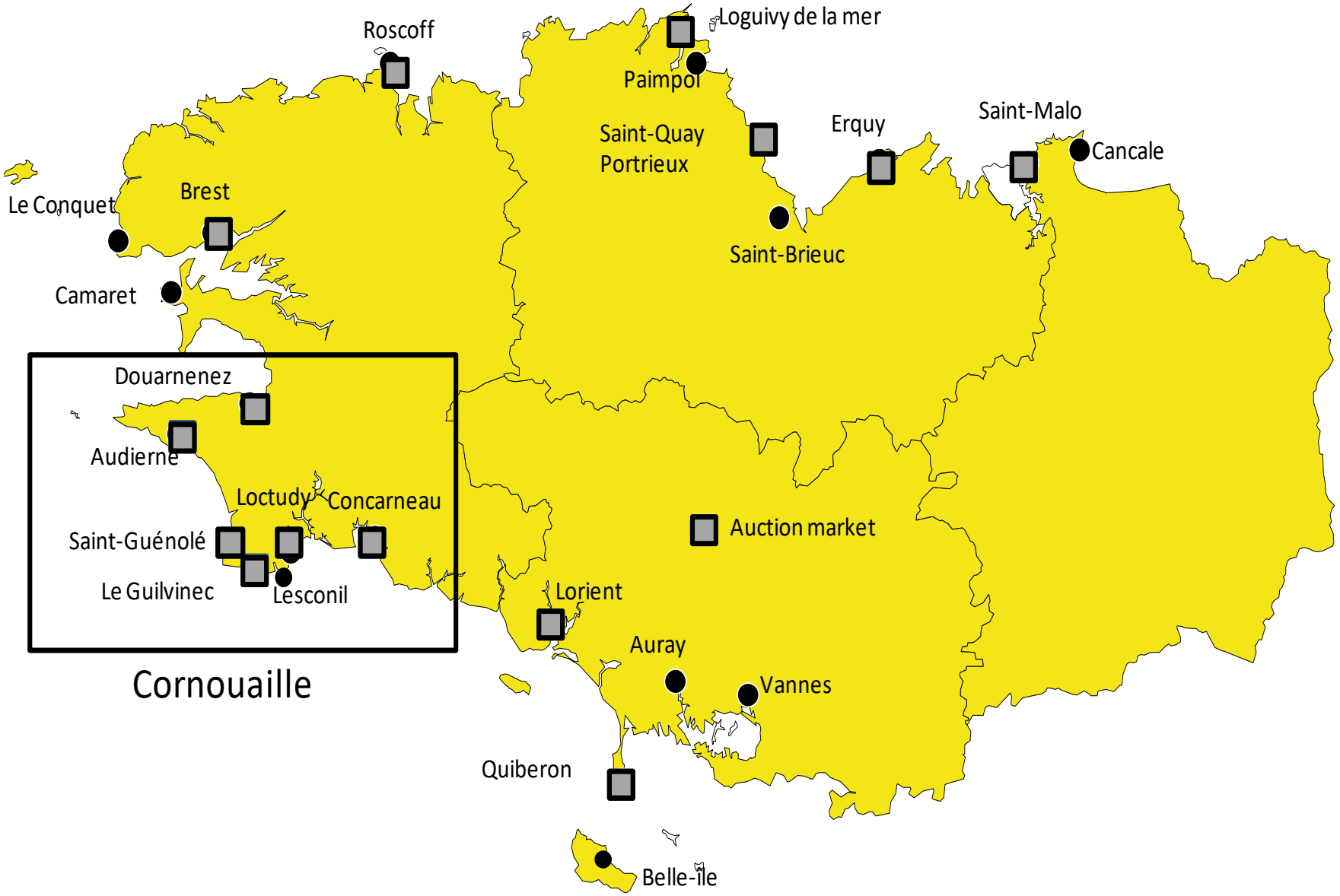
✓to contribute to the economic development,

✓reducing environmental impacts,

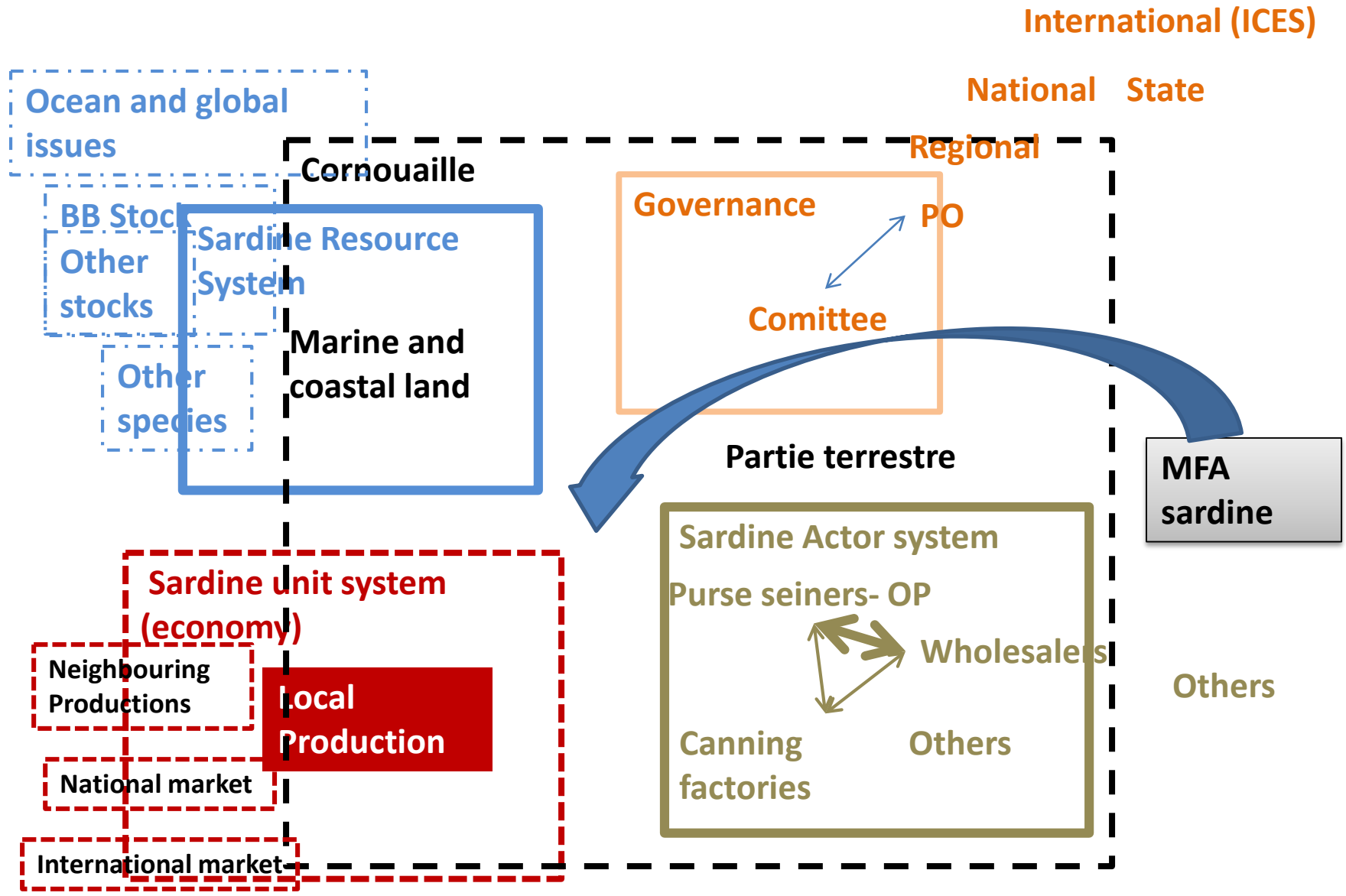
✓and improving the well-being of the population

✓of the studied social-ecological system?

Map of Brittany with Cornouaille (box) and landing harbors (grey squares)



Presentation of the socio-ecological Sardine subsystem in Cornouaille



Legend : ICES= International Council for the Exploration of the Sea; PO = Organization of Producers; Comm. = Commercial; BB= Bay of Biscay

(personal adaptation from MacGinnis&Ostrom, 2012)

Importations (Marocca…)

+

Domestic Extracted Used (DEU)

=

Domestic Material Input (DMI)

Indirect flows related to importations + ***(Discards)***

=

Total Material Requirement (TMR)

Domestic Material Consumption (DMC)

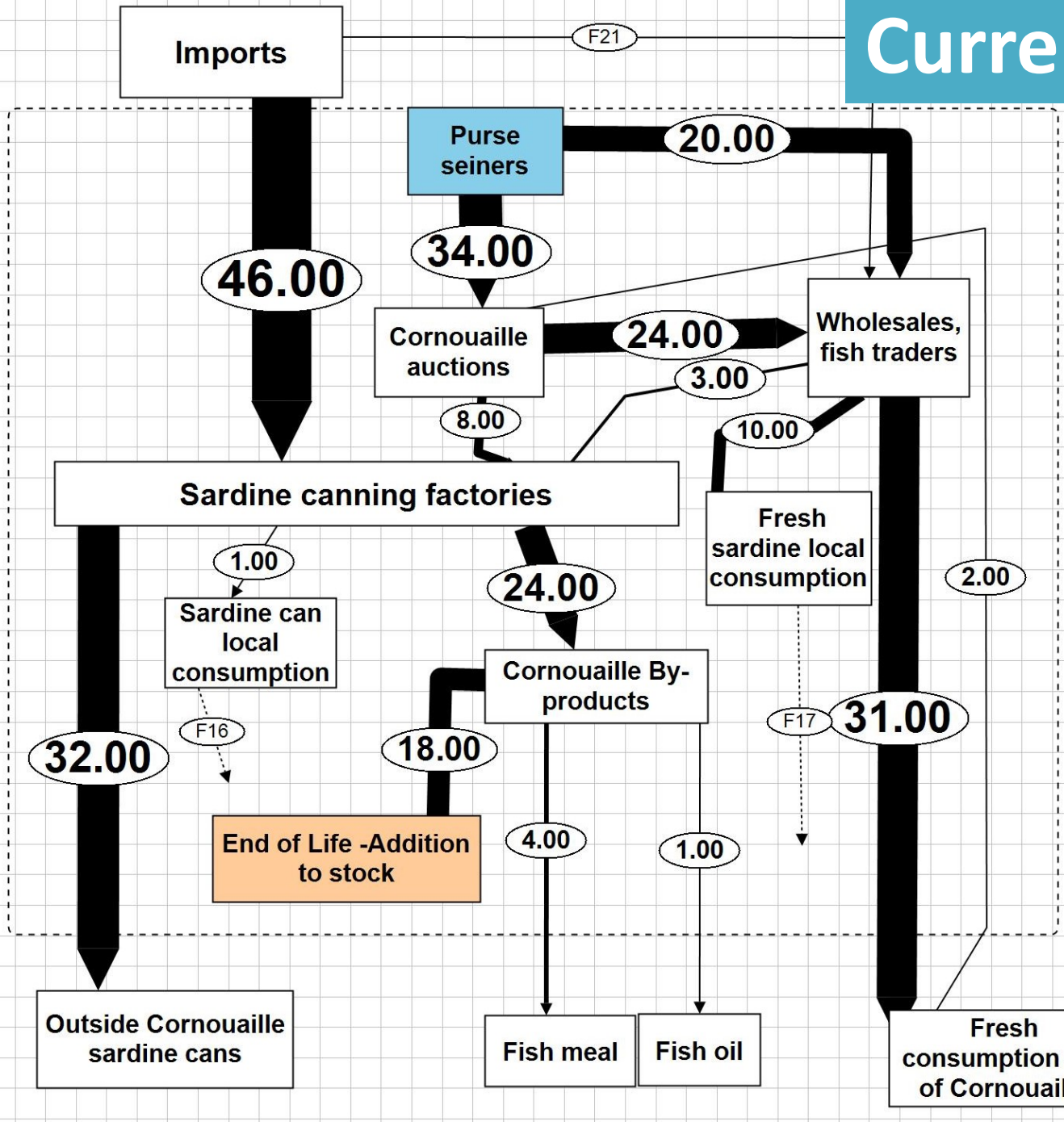
- Canning
- Wholesales, fishtraders
- By-products
- Consumption
- End of Life
- Others

\- Exportations

Description of the mass balance of Sardine resource in French Cornouaille

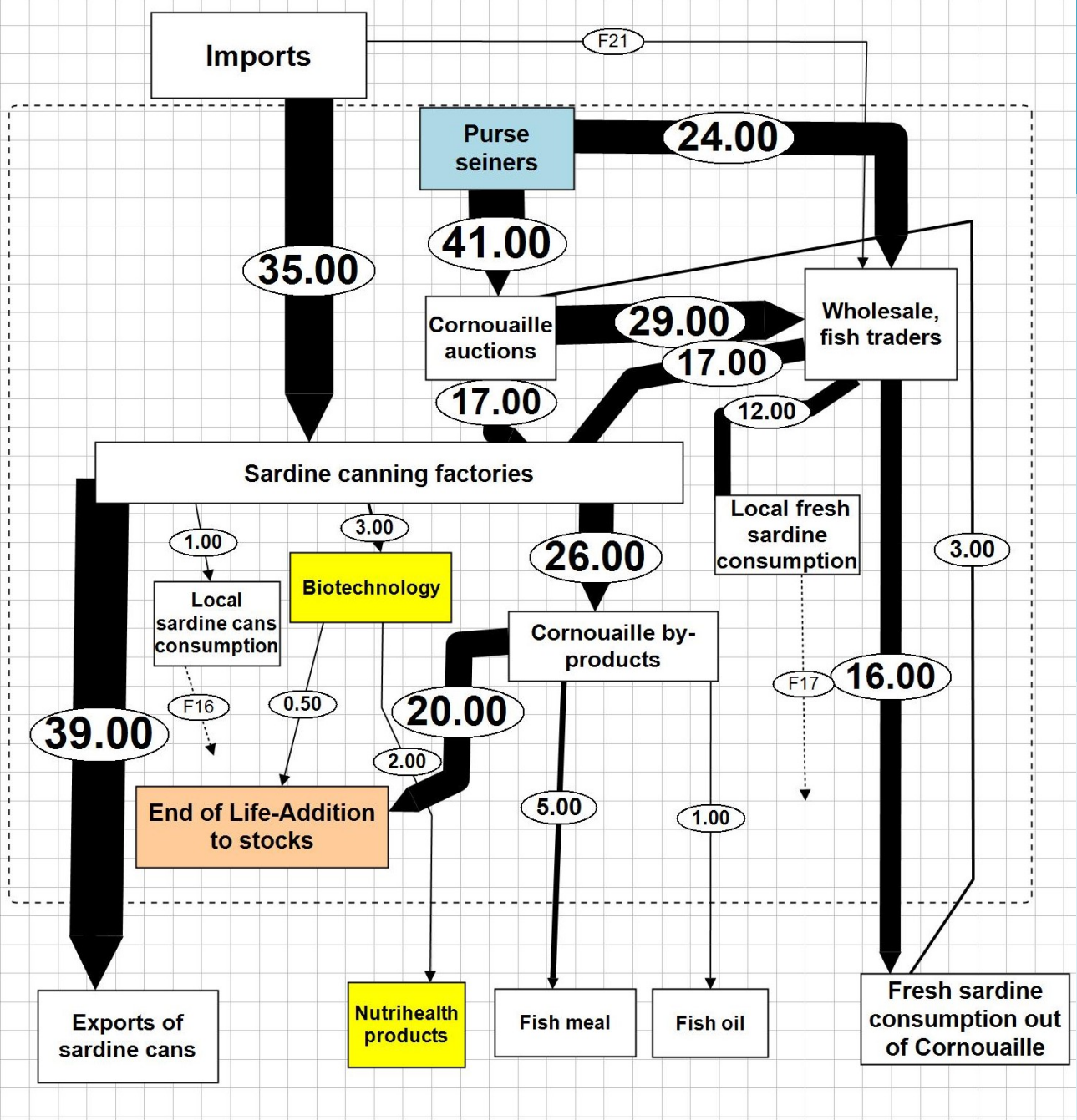
Sources photos : http://www.comitedespeches-finistere.fr/notre-flotille/zoom-metier/les-bolincheurs
Et http://www.pecheursdebretagne.eu/especes/la-sardine/ et www.Espace agro.com

Current situation



Mass balance (in percentage of the total input flow of sardine entering the system) of the whole Sardine subsystem in Cornouaille - (personal elaboration)

Circularity scenario



Mass balance (in percentage of the total input flow of sardine entering the system) of the whole Sardine subsystem in Cornouaille - scenario circularity "2_{bis}" (personal elaboration)

Canning factories are supplied on a ratio 50-50 between imports and local production. Sardine local production is less directly exported by the wholesale traders .
Sardine by-products more valued with a new biotech plant that captures a part of by-products for nutrihealth high-value products.

Results of explored *scenarii* through Sardine bioresource Material Flow Analysis in the system

Legend : DEU : Domestic Extraction Used, TMR : Total Material Requirement, DMC : Domestic Material Consumption according Barles (2014); FTE : Full Time Employment ; VAT : Total added value

	Current situation	Business as usual	Circularity with biotechnology
Local production in t	**15038**	**15038**	**15038**
Importations in t	**12910**	**16009**	**8005**
$FTE_{Sardine}$	**1140**	**1155** *+1%*	**1126** *-1%*
VAT sardine (10^6 €)	**68.3**	**69.3** *+1%*	**67.5** *-1%*
Material Intensity Requirement/FTE (t/FTE)	**25.30**	**27.85** *+10%*	**20.97** *-17%*

FTE : Full Time Employment
VAT : Total Added Value

Ressource sparing

Conclusion :

➢ **Interest of the Material Flow Analysis as a circular economy (industrial ecology) tool**

- **to identify some of the issues related to the sustainable development of coastal socio-ecological systems**
- **and to display future alternative *scenarii.***

➢ **News prospects of research and development, inspired by CE, on sustainable value creation in local fisheries-dependent SES.**

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Link : https://tel.archives-ouvertes.fr/tel-02109392